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MESSAGE FROM ISCB

# Applying, Evaluating and Refining Bioinformatics Core Competencies (An Update from the Curriculum Task Force of ISCB's Education Committee)

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The Curriculum Task Force (CTF) of ISCB's Education Committee seeks to define curricular guidelines for those who educate or train bioinformatics professionals at all career stages. A recent report of the CTF [1] presented a draft set of bioinformatics core competencies, derived from the results of surveys of (1) core facility directors, (2) career opportunities, and (3) existing curricula.

Since the publication of its 2014 report, the CTF has focused on the application of the guidelines in varied contexts to identify areas where refinement is needed. As a first step, the task force held an open meeting at the ISMB conference in July 2014. The ideas discussed at the meeting spawned four working groups (WGs), which focus on (i) defining core competencies for specific types and levels of bioinformatics training, (ii) mapping the curriculum guidelines and competencies to existing materials in order to identify the need for development of new materials, and (iii) identifying where revision of the guidelines may be valuable. The CTF is engaging the ISCB community through open WG meetings at ISCB's official conferences. Thus far, the WGs have convened at the ISCB Great Lakes Bioinformatics Conference (Purdue University, May 2015) and at the ISMB/ECCB Conference (Dublin, Ireland, July 2015). Additionally, the CTF held a workshop at the Annual General Meeting of the Global Organization of Bioinformatics Learning, Education and Training (Cape Town, South Africa, November

2015). Specifically, the draft competencies have been employed in a wide range of activities and contexts (see [Table 1](#) and [2–11]), including the development of new curricula, the analysis of existing curricula, and the creation of new roles involving bioinformatics. These activities have resulted in the identification of several areas where refinement would be useful:

- **Identify different levels or phases of competency.** It would be helpful to define different phases of competency development, or different levels of competency appropriate for distinct roles.
- **Define competency profiles for disciplines that don't fit into our current silos.** Bioengineering provides an illustrative example of a discipline that requires core competency in

**Table 1. Summary of the activities of the ISCB Curriculum Task Force.**

Organization	Program (level-U/G/P)	Activities	Working Group(s)
American Association of Medical Colleges	Graduate Research Education and Training Group-G	<ul style="list-style-type: none"> <li>• bioinformatics education for academic medicine</li> <li>• assessment</li> <li>• levels of competency</li> </ul>	User (physician-scientist)
Carnegie Mellon University	Biology-U	<ul style="list-style-type: none"> <li>• core computational biology class (biologists)</li> <li>• computation throughout biology curricula</li> </ul>	Scientist
Carnegie Mellon/University of Pittsburgh	PhD Program in Computational Biology-G	<ul style="list-style-type: none"> <li>• a model for the expectations of entering students</li> </ul>	Engineer
EMBL-EBI	Professional courses-P	<ul style="list-style-type: none"> <li>• mapping courses to competencies</li> </ul>	Content
GOBLET	Learning, Educ & Training-P	<ul style="list-style-type: none"> <li>• training portal for course information and materials</li> </ul>	Content
H3ABioNet	Pan African Bioinformatics network-G	<ul style="list-style-type: none"> <li>• identifying modules</li> <li>• foundation for developing content</li> </ul>	Engineer, Scientist, User
Health Education England	England's clinical bioinformatics working group-P	<ul style="list-style-type: none"> <li>• defining the role of a clinical bioinformatician</li> <li>• enabling use of bioinformatics for clinical decision-making</li> </ul>	User (healthcare professional)
Indiana University	Bioinformatics Programs-G	<ul style="list-style-type: none"> <li>• making discipline-centric courses interdisciplinary</li> </ul>	Engineer, Scientist
Network for Bioinformatics in Life Sci. Education	NSF-funded network of investigators-U	<ul style="list-style-type: none"> <li>• integrating bioinformatics into life sciences curricula</li> </ul>	Scientist
Ohio University	bioinformatics certificates-U/G	<ul style="list-style-type: none"> <li>• training for each bioinformatics role</li> </ul>	Engineer, Scientist, User
Springer	ISCB book series	<ul style="list-style-type: none"> <li>• mapping</li> <li>• identifying needs</li> </ul>	Content
University of Cambridge		<ul style="list-style-type: none"> <li>• mapping courses to competencies</li> <li>• integrating bioinformatics into life sciences curricula</li> </ul>	Content, Scientist
University of Illinois	Bioengineering-U	<ul style="list-style-type: none"> <li>• training bioengineers</li> </ul>	Engineer
University of New South Wales	Bioinformatics Engineering-U	<ul style="list-style-type: none"> <li>• program design and accreditation</li> </ul>	Engineer
University of Virginia	Bioinformatics Course -G	<ul style="list-style-type: none"> <li>• biological principles for analyzing genomic data</li> </ul>	Scientist
WikiProject Computational Biology	Wikipedia, Wikidata, and other Wikimedia projects	<ul style="list-style-type: none"> <li>• organizing articles</li> <li>• crowd curation</li> <li>• mapping</li> <li>• strategic planning</li> </ul>	Content

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bioinformatics but does not fit into our current categories. There are almost certainly others. It would be helpful if we could provide some guidance on how to produce ‘hybrid’ competency profiles, perhaps borrowing some competencies from the TF’s core set and others from different disciplines. The LifeTrain initiative ([www.lifetrain.eu](http://www.lifetrain.eu)) [2, 3] is collecting competency profiles for a range of disciplines of relevance to the biomedical sciences and may provide a useful resource kit for this.

- **Broaden the scope of the competency profiles in response to cutting-edge and emerging research.** Current areas requiring improvement include incorporating competencies that capture a fundamental understanding of the biological principles central to analyzing biomolecular data, and broadening the user WG to include applications beyond medicine.
- **Provide guidance on the evidence required to assess whether someone has acquired each competency.** For undergraduate, Master’s and PhD programs, learning outcomes for each competency, perhaps with examples of appropriate means of assessment, would be valuable. For established professionals who need to assimilate competencies into their working lives, a different approach may be required (such as keeping a portfolio to capture evidence of competency); the CTF should seek guidance from relevant professional bodies, especially in regulated professions such as healthcare.
- **Provide indicative course content or examples of programs that map to the competency requirements.** We do not wish to prescribe what course providers should teach or how they should teach it; however, if a course provider is designing a course to meet a specific competency requirement, it may be helpful to find examples of other programs that do this successfully. One way of achieving this is by mapping existing training content to the TF’s competencies. Another way might be to provide an indication, perhaps based on several courses, of the course content that would meet the competency requirements. This would give course providers the freedom to build their own course syllabi without having to reinvent the wheel. Initiatives to collect examples of Creative Commons (or otherwise reusable) course materials will provide an extremely valuable bank of training materials that could be mapped to the core competencies.

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